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INVESTIGATIONS ON "TUBA".

BY B. A. R. GATER.

@g.r.

INTRODUCTION.

IT is with some considerable hesitation that the following paper is published owing to the inconclusive nature of many of the results. So many enquiries are being received on the subject of "tuba" or "toeba", and so many misapprehensions about it seem to exist, that the records obtained in this laboratory were considered to be worth while publishing even at the risk of making public more or less "half-baked" results. Moreover the investigations on the toxicity of the various plants have gone as far as they can under existing conditions in this laboratory, and the results obtained, being of some practical use, may interest planters.

As an insecticide, derris, which is the substance to which the name "tuba" is usually applied, is not the wonderful insecticide which is sometimes imagined. It is a good insecticide for certain purposes, and except that it is not a volatile poison may be compared to nicotine in efficiency. Nicotine is largely used in horticulture, and it is probable that derris will replace this rather expensive substance to a great extent. Derris will not, on the other hand, replace the arsenical insecticides, which have entirely different properties. Although it is both a contact and a stomach poison, its practical use will to a large extent be limited to the former class. Nevertheless it is a most convenient substance for use on estates in this country, where a little can be grown and is always at hand when required, and this practice will probably be followed more widely in the future. On the other hand, as far as its growth for export is concerned, it should be mentioned that the trend of modern knowledge on insecticides is towards the use of chemical as opposed to plant-products, and the former will always be produced more cheaply than the latter, especially if they are in the nature of by-products of other industries. Thus quite recently it has been found that certain fluorine compounds are of high insecticidal value, and of these, sodium fluosilicate is considered to be superior in many ways to the arsenicals. This substance is a by-product in the manufacture of acid phosphate, and is less than half the price of calcium arsenate (S. Marcovitch, Univ. of Tennessee, Agric. Expt. Sta. Bull. 131),

Against substances of similar insecticidal value which are by-products of a chemical industry no plant-product can hope to compare in price.

Regarding the "non-poisonous" nature of derris, the term is merely comparative. Although not to be compared with the arsenicals or nicotine in toxicity to the higher animals, it is nevertheless toxic, and should not be handled carelessly. Derris is also used by certain tribes as an abortifacient.

As an insecticide there are roughly three ways of applying derris, viz:—as a water 'extract' in the form of a spray, as a dust, and as a spray made by emulsifying with water an extract obtained by chemical means. The chemical extracts have not been used largely up to the present time owing to difficulties in extraction and the expense of the solvents used. Methods have lately been perfected, however, and we may expect to see concentrated extracts more widely used. The dust is not easy to obtain, and requires special machinery for its manufacture, but is efficient and easily applied. Or estates which grow derris the water 'extract' is still the most convenient form of application, and the following is the method of preparation which has been found efficient in this country:—

Derris roots	-	2—4 lbs.
Soap	-	2 lbs.
Water	-	10 galls.
To be diluted at the rate of		1 in 10.

The derris is cut into small pieces and thoroughly pounded to a pulp. If a stone mortar or similar appliance is available a little water may be added to facilitate pounding. Five gallons of water are placed in a barrel or wooden tub and the derris pulp is enclosed in a cloth and steeped in the water, any "extract" which remains from the pounding being added.

The soap is sliced and dissolved in 5 gallons of water, using heat if necessary. When the soap has dissolved, the solution is put aside to cool, and the derris pulp is thoroughly squeezed until all the milky juice has been 'extracted.' The soap solution is now mixed with the milky fluid obtained from the derris, and the stock solution diluted at the rate of 1 in 10 of water. Iron containers should not be used.

This spray will be found useful for general purposes, but for small soft-bodied insects less derris may be used. The actual amount necessary will depend to a certain extent upon the efficiency with which it is pounded and squeezed. The spray will not keep for more than two days without losing its efficiency.

The following remarks are divided into two parts, the first dealing with toxicities of various plants which go under the collective name of "tuba," while the second deals with the insect pests on

Derris spp. as far as they are at present known. It is convenient to give a short summary here:—

1. The Malay word "Tuba" is not confined to species of *Derris*.
2. Eleven "tuba" plants not *Derris* sp. were found to have no practical value as insecticides.
3. The species of *Derris* vary in toxicity, as do apparently varieties of the same species.
4. *Derris elliptica* variety "Tuba rimba" appeared to be the best plant for use on estates.
5. Notes are given on 11 insects which feed on the leaves of *derris*, and a serious pest on the stored roots is mentioned.

PART I.

THE INSECTICIDAL VALUE OF MALAYAN PISCICIDES.

The natives of Malaya, especially the Sakai or aboriginal tribes, have long been versed in the art of utilising various plants as poisons in the pursuit of food. Numerous arrow-poisons are known, with which it is possible to bring down heavy game, but in addition to these certain plants are used for poisoning fish in rivers and streams. The plant used is pounded and thrown into the river, the fish rising to the surface in a dead or stupefied condition, where they are caught by a line of men drawn across the stream. Although now generally prohibited on account of the enormous waste of life, fish drives, as they are called, still form part of the entertainment given by native chiefs on fête-days.

The commonest substance used for poisoning fish is the pounded roots of the plant known in Malay as "tuba", the plant most frequently referred to under this name being a species of *Derris* of the order Leguminosæ. *Derris* is now quite a well-known insecticide, having been used for a long time by Chinese market gardeners, and more recently as the principal constituent of various proprietary insecticides. Considerable work has been done on both the chemistry and toxicity of the substances contained in this plant by numerous investigators, among whom may be mentioned Greshoff, Power, Sillevoldt, Ishikawa, Mc. Indoo and others, Tattersfield, Roach, Fryer and Stenton.* Nearly all these investigators, however, confined their researches to one species, *Derris elliptica*.

On enquiry among Malays it was found that there was a large number of plants in this country which, although called "tuba" in the vernacular, were not the same, and could not always be referred to the genus *Derris*; and that the word "tuba" even extended, in some parts of the Peninsula, to inorganic poisons such as arsenic, which has been called "tuba tikus" (rat poison).

* For papers by the last four investigators, and a bibliography, see "Annals of Applied Biology," Vol. X, No. 1.

It was therefore decided that it would be advisable to make a collection of all the "tuba" plants which could be obtained, and to test their insecticidal properties, and at every opportunity specimens of "tuba" were obtained from the natives and kept in the entomological laboratory for examination.

For the sake of simplicity the plants obtained were divided into two groups, the *Derris* species and the non-*Derris* species, and this division is adhered to in the present paper. From the start, however, it was obvious that there would be great difficulty in identifying the material, and it was not until the beginning of the present year that it was possible to get even a portion of the material named. Most of the non-*Derris* plants were obtainable only as roots, bark or other portions, and in the case of the *Derris* species the roots only were generally sent in. Owing to the kindness of I.H. Burkill, Director of the Botanical Gardens, Singapore, a portion of the material was eventually identified, and the author's thanks are due to him for the trouble he took in identifying a very unpromising number of specimens.

The results given in the present paper are preliminary, and much more work will have to be done before the conclusions arrived at can be set down as accurate. Especially is this so in regard to the comparative toxicities which must be tested on a larger number of insects of different species.

NON-DERRIS SPECIES.

Through the generosity of W. H. Barnes and G. E. Mann, Agricultural Field Officers for Negri Sembilan and Selangor, a collection of plants was obtained from the Sakai in their areas. Not all of them have been identified, as will be seen from the following table:—

TABLE I.

Natural Order.	Name.	Vernacular.
Menispermaceae	- <i>Coscinium Blumeum</i> , Miers	Tuba kupak.
Guttiferae	- <i>Calophyllum ? spectabile</i> , Willd.	- Kulit bentangor.
Guttiferae	- <i>Calophyllum ? spectabile</i> , Willd.	- Akar bentangor.
Myrtaceae	- <i>Barringtonia speciosa</i> , Forst.	- Putat.
Ebenaceae	- <i>Diospyros Wallichii</i> , King and Gamble	- Tuba buah-daun.
"	- <i>Diospyros Wallichii</i> , King and Gamble	- " " -akar.
Styracaceae	- <i>Styrax benzoin</i> , Diy.	- Kemehyan.
Dioscoreaceae	- <i>Dioscorea piscatorum</i> , Prain and Burkill	- Tuba cherok.
...	- Unidentified	- Tuba janirok.
...	"	- " tapah.
...	"	- " hantu.
...	"	- " sasan.
...	"	- " riam.

Since all the plants are simply pounded and thrown into the stream for poisoning fish it is evident that water must be able to extract the toxic substances. For testing the insecticidal values of the plants a water extract was made by chopping up a quantity of the plant as fine as possible and then pounding a weighed quantity in a mortar with a little water, until a pulp had been obtained. This was then strained through muslin and the remaining pulp well squeezed out in the water. The liquid samples thus obtained were then made up to equal volumes with water.

Coscinium Blumeianum.—This is a climbing plant which is usually found on flat land and in secondary jungle growth, and its long yellow tubers are eaten by the Sakai. It is, in fact, usually found in abandoned Sakai clearings in the jungle. The bark is used as a fish-poison in the usual way, i.e. pounding and throwing it into the stream. The bark and stems were hard and yellow in colour, and were difficult to cut up and pound. With water a light 'curry powder' coloured liquid was obtained which was slightly frothy, and had a tendency to stain the muslin yellow.

Calophyllum spectabile.—A jungle tree which provides a first-class timber, found on hilly and flat ground and in swamps. The Sakai say there are many varieties of 'Bentangor' so that the specific identity is doubtful. The bark of the trunk and roots is used.

- (a) Bark. Easily pounded, giving a reddish yellow liquid.
- (b) Root bark. Difficult to pound and gives a coloured liquid which is similar to that obtained from the trunk but lighter.

Barringtonia speciosa.—This tree grows to a girth of four feet on dry flat land only, and is planted as an ornament. The bark was not very easily turned to pulp, and gave a light brown liquid.

Diospyros Wallichii.—Timber can be obtained from this tree, which grows to a girth of about four feet on hilly land, but the timber is not used. The bark of the trunk and the leaves are employed.

- (a) Leaf. Easily pounded, giving a dark green fluid, probably mostly chlorophyl. The liquid has a faintly aromatic smell.
- (b) Bark. Fairly easily pounded, giving a coffee-coloured fluid which shows no tendency to froth, even when soap is added.

Styrax benzoin.—This tree is found on hilly land and is tapped by the Malays who use the resin as an incense on various ceremonial occasions. The bark as well as the roots are apparently used as a fish-poison. The wood is light red in colour; difficult to reduce to a pulp; gives a frothy, reddish liquid.

Dioscorea piscatorum.—This is a newly described species of *Dioscorea*, and has been proved to be toxic to fish by Burkill and

Holttum.* The tubers are easily pounded and give a red liquid which is distinctly frothy.

Tuba janirok.—Similar to tuba hantu, fairly easy to pound. A stronger aromatic smell than tuba hantu, similar to gum benzoin.

Tubah tapah.—This and the following plants have not been identified and were received as roots only. The roots suggest the fibrous qualities of *Derris* but it is impossible to say what they are. Fairly easy to pound, giving a light coffee-coloured liquid.

Tuba hantu.—Fairly easily pounded, colour of liquid similar to tuba tapah. Faint aromatic smell.

Tuba sasan.—Dark coffee-coloured liquid obtained. Root fairly easy to pound.

Tuba riam.—Fairly easily pounded, light yellow translucent fluid.

For trials of the insecticidal value of these plants 5 grms of the chopped samples were well pounded in a mortar, the pulp squeezed and strained through muslin, and the liquid made up to 100 cc. with water. At the first trial, although some showed evidences of being toxic to insects only two showed any promise, viz: *Dioscorea piscatorum* and *Tuba janirok*. The fact that all these plants are used as fish poisons does not necessarily mean that they will be toxic to insects, and it is possible that not all of them are toxic to fish. No opportunity of testing this point was forthcoming, but it is well known that a number of quite innocuous plants is included in the various poisons made by the Sakai on account of the ritual which accompanies their manufacture, and it is quite possible that some of the above plants are included in fish-poisons with, say, a species of *Derris* from which the real toxic substance is derived. On the other hand it might be found that the fresh plants held toxic principles which so changed their constitution on drying that their toxicity is lost. In addition it is possible that some of the last four may be species of *Derris* which are non-toxic. The water extracts, however, showed none of the characteristic appearance and smell of the known species of *Derris* which have been tested.

It was considered that none of the plants would be of importance unless they exhibited a toxicity at least equal to a commonly grown *Derris*, and a variety of *D. elliptica* (*Tuba rimba*) which is grown on a large scale, was used as a basis of comparison in the tests. Sodium oleate was used at the rate of 0.25 per cent to act as a wetting agent in all the experiments, the required quantity being added in solution to the water extracts. Throughout the tests the mature larvae of *Parasa herbifera*, Walk. (Limacodidae) were used, ten larvae being employed for each test. By means of a brass wire gauze cage they were totally immersed in the liquid for half a minute, being caged with their food plant directly afterwards. They were handled by means of clean camel-hair brushes. The results are shown in Table II.

*The Gardens' Bulletin, Straits Settlements, Vol. III Nos. 7-8, p. 260.

TABLE II.

Non-Derris Species.

D = Dead.

C = "Comatose".

A = Alive.

P = Pupated.

Plant used.	Stren- gth % of root, etc.	RESULTS.											
		After 2 hrs.			After 24 hrs.				After 48 hrs.				
		D.	C.	A.	D.	C.	A.	P.	D.	C.	A.	P.	
<i>Coscinium Blume- anum</i> ...	5		4	6			6	4			5	5	
	2.5			10			10				10		
<i>Calophyllum ? spectabile</i> (bark)	5			10			10				8	2	
	2.5			10			10				10		
<i>Calophyllum ? spectabile</i> (root)	5			10	2		8		2		6	2	
	2.5			10		1	9		1		7	2	
<i>Barringtonia speciosa</i> ...	5			10			8	2	2		2	6	
	2.5			10			10				7	3	
<i>Diospyros Wallichii</i> (leaf)	5			10	2		6	2	2		2	6	
	2.5			10			9	1			5	5	
<i>Diospyros Wallichii</i> (root)	5		2	8			10				6	4	
<i>Styrax benzoin</i> ...	5			10	2	2	2	4	6			4	
	2.5			10		1	7	2	1		3	6	
<i>Dioscorea pisca- torum</i> ...	5		6	4	6	4			8			2	
	2.5		1	9	1		8	1	2		6	5	
	.5			10			10				10		
Tubah tapah ...	5			10			8	2			4	6	
Tuba hantu ...	5		4	6		2	8		4		2	4	
	2.5			10			8	2			5	5	
Tuba sasan ...	5		2	8	2		6	2	2		4	4	
	2.5			10			7	3			7	3	
Tuba janirok ...	5		8	2	10				10				
	2.5		1	9		1	6	3	1		3	6	
	.5			10			9	1			6	4	
Tuba riam ..	5			10			8	2			2	8	
<i>Derris elliptica</i> ...	5	10			10				10				
Control ...	2.5	10			10				10				
	.5	10			10				10				
Sodium oleate ...	.25			10			10				10		
Control ...	.25			10			4	6			8	2	
	.25			10			7	3			2	7	

The pupations recorded are considered to have been accelerated slightly by the immersion in the various fluids. It was difficult at times to decide whether the "comatose" state was due to approaching pupation or to the action of the fluid, and in some cases the comatose in livivuals merely pupated and emerged normally later on. The normal time of pupation, according to the breeding records for the batch of larvae used, would have been from three to four days after immersion, and although the date cannot accurately be forecasted for individual larvae in a large batch, it is thought that premature pupation as a result of treatment took place to a certain extent. All larvae which pupated completed their development and emerged, some of the moths being a little undersized. This last is not considered to have much significance, however, since there is some variation in this species in nature.

It will be seen that although some toxicity is shown by several of these plants, it does not compare with that shown by *Derris*, especially on dilution. It is thus concluded that none of the plants tested will become of any practical use as an insecticide.

DERRIS SPECIES.

According to Ridley (Flora of the Malay Peninsula, Vol. I) there are eleven species of *Derris* in this country, viz:--

Name.	Habitat.	Distribution.
<i>Derris sinuata</i> , Thw.	Tidal rivers	- India, Ceylon, Indo-China, Malaya.
<i>Derris thyrsiflora</i> , Benth.	- Open country	- Sumatra, Java, Malaya.
<i>Derris scandens</i> , Benth.	- Woods near sea	- Indo-Malaya, Australia.
<i>Derris dalbergioides</i> , Baker.	- Open country	- Tenasserim, Malaya.
<i>Derris uliginosa</i> , Benth.	- Mangrove swamps	- East Africa, Malaya, Mascarenes.
<i>Derris elegans</i> , Benth.	- ...	Sumatra, Tenasserim, Malaya.
<i>Derris affinis</i> , Benth.	- ...	Java, Malaya.
<i>Derris amoena</i> , Benth.	- Lowland forests	- Tenasserim, Malaya.
<i>Derris elliptica</i> , Benth.	- Rocks. Cultivated	- Cambodia, Siam, Malaya.
<i>Derris malaccensis</i> , Prain.	- Forests	- Tenasserim, Siam, Borneo, Malaya.
<i>Derris Yappii</i> , Craib.	- ...	- Malaya.

Derris afinis and *D. uliginosa* are synonymous, so that the number of species is reduced to ten. Mc. Indoo, Sievers, and Abbott, in their paper published in the Jour: of Agric: Research, Vol: XVII p. 177, give some information on the toxic values for several species, but of the species known in Malaya only *scandens*, *uliginosa* and *elliptica* are mentioned. They state that *uliginosa* and *elliptica* were found to be satisfactory as insecticides and that *scandens* and the following species were not:—*D. Koolgibberah*, Baily, *D. oligosperma*, K. Schum. (both from Australia) and *D. robusta*, Benth. (from India). With the elimination of *D. scandens* the number of species in Malaya which might repay investigation is reduced to nine.

For a long time efforts were made to secure properly identified specimens of the species of *Derris* known to exist in Malaya, but without success. Eventually, however, again through the kindness of I. H. Burkill, authentic specimens of *D. elliptica*, *D. malaccensis* and *D. thyrsiflora* were obtained. In addition to these several varieties of *Derris* were obtained, but their specific identity is mostly uncertain. They are as follows:—

Vernacular.	Identification.
Tuba rimba	<i>Derris elliptica</i>
„ merah	„ „
„ puteh	„ „
„ gagah	<i>Derris</i> sp.
„ standing	„ „ (from Sarawak)
„ creeping	„ „ „ „

Both *malaccensis* and *thyrsiflora* exhibit toxic properties, and all these samples give the milky fluid of peculiar smell common to *derris* roots. There is very little distinction between the roots of *elliptica* and *malaccensis*, but *thyrsiflora* is easily recognised by its light colour and by the light scaly character of the root-bark. Having these varieties and species in hand, it was desired to compare their toxic content or their comparative behaviour towards insects. At the outset, however, it was evident that no facilities existed for making a true comparison. The toxic principles are changed by the use of heat, necessitating any extraction by solvents being performed under reduced pressure. In addition, extraction is difficult unless the roots are ground to an exceedingly fine powder. No suitable apparatus was available with which to conduct these operations.

As regards the water extract the same error which applies to extraction by chemical solvents is present if the roots are not ground equally fine, and pounding in a mortar is too inaccurate a process for true comparisons. Further, it has been found by Mc. Indoo that

water is not an efficient vehicle for derris unless the fine powder is suspended in it, and by straining the pounded or unevenly ground roots no certainty of having the same amount of suspension in each sample could be maintained. For these reasons it was considered that a comparison of the toxicities of the species would possibly be misleading if carried out in Malaya with its primitive laboratory facilities.

Apart from the inaccuracies likely to occur in the laboratory under these conditions, there is also the question of the age of the plant, it being very possible that unless plants grown under identical conditions and of exactly the same age were used, more errors would be introduced. It has therefore been decided that now properly identified plants of a few species can be obtained they should be handed over to some institution where full facilities for comparison exist. From one aspect however, a comparison of the toxicities such as can be done in a very rough way might be useful. Many estates in Malaya grow a little derris for use on the estate when required, and in this case the root and stems would be coarsely ground or pounded in a mortar, the water extract being used. From this point of view a few notes on the various varieties are given. In the laboratory an ordinary drug mill was used, the root being ground as fine as possible with this machine. The roots varied in their behaviour in the mill, and they were graded by inspection in the order of the fineness of the product. In Table III the root which gave the finest powder is placed first, that which gave the coarsest last. The moisture content was roughly estimated for each root and is included in the table.

TABLE III.

Order of fineness.	Moisture content %
Tuba rimba (finest)	... 7.4
<i>D. elliptica</i>	... 10.3
Tuba merah	... 3.3
„ creeping	... 9.4
<i>D. malaccensis</i>	... 9.3
Tuba gagah	... 7.3
„ puteh	... 8.0
„ standing	... 9.6
<i>D. thyrsiflora</i> (coarsest)	... 11.1

One gramme of the powdered roots was then weighed and pounded for two minutes in a mortar. The resultant pulp was squeezed through muslin in water and washed, the liquid being then made up with water so that the volume contained 1% of the dry root.

When the water extracts are left standing for twelve hours a fermentation process sets in, which appeared to be most active with

D. elliptica and *D. malaccensis*, a greyish scum being formed on the surface. Although this point has not been investigated, it is believed that this fermentation reduces the toxicity of the extract, since samples which had been left for some days showed a marked falling off in this respect. Associated with the scum is a gram-negative organism which appears as short chains 7—8 μ . in length. All tests were therefore made with the freshly prepared extracts.

For these tests the larvae of a Pyralid, *Tirathaba* sp. were used, the total immersion method being employed. Since these larvae showed some susceptibility to sodium oleate it was not used in these tests, but the immersion period was increased to fifty seconds. Twenty larvae were used for each test, the results being shown in Table IV.

TABLE IV.

Derris Species.

D = Dead.

C = "Comatose."

A = Alive.

Root Used.	Strength. %	Results after 24 hours.		
		D.	C.	A.
<i>D. elliptica</i>	0.2	18		2
Tuba rimba	0.2	16		4
Tuba merah	0.2	14		6
Tuba creeping	0.2	12		8
Tuba gagah	0.2	10		10
<i>D. malaccensis</i>	0.2	8		12
Tuba standing	0.2	8		12
Tuba puteh	0.2	6	4	10
<i>D. thyrsiflora</i>	0.2	2		18

On referring to Table III it will be noticed how closely these results agree with the order of fineness of the powders obtained, so that the comparison is probably more in the nature of the ease with which the various roots can be prepared than of their toxic content. It is also noticeable that, with the exception of Tuba puteh, those which are known to be *D. elliptica* appear to be the most toxic. Other than the authentic *D. elliptica*, which appears to be the best, Tuba rimba, Tuba merah and Tuba puteh are almost certainly *D. elliptica*. As grown in Malaya there are variations in the plants,

Tuba rimba, Tuba merah and Tuba puteh being fairly easily distinguished from one another. The authentic sample of *D. elliptica* appears to be the same as the variety known as Tuba rimba, and from the results there appears to be little difference in toxicity. From these preliminary tests it would appear, therefore, that *D. elliptica* is the best of these species for use as an insecticide, and that the variety known locally as Tuba rimba is the best one to grow for use on estates.

PART II.

NOTES ON THE PESTS OF DERRIS.

Considerable interest has been shown recently in regard to growing derris ("tuba") for sale as the basis of insecticides and also as a convenient and cheap substance which can be used for the control of certain insects on estates. During the course of investigations on the various species and varieties of this plant some insect pests have been discovered, and since nothing can be found on the subject in the literature available it was thought that the publication of an annotated list of the pests so far recorded on derris in Malaya might be of interest.

Until quite recently the insects found feeding on this plant were limited to the leaves. When grown under plantation conditions there is always a certain amount of injury from leaf-eaters, but it is only occasionally of a serious nature. If grown on a large scale, however, this injury will in all probability increase in severity until control measures may have to be undertaken. The roots and stem on the other hand have lately been found to be attacked in store. Whether the infection took place in the field or after they were stored is not yet certain, but the damage done is of a serious nature and may occur in stores in this country and during transshipment. In the following notes a reference is given to the monograph which was accessible and also to the books dealing with this region of the world. References have been cut down as much as possible, full references being given in the book or monograph quoted. Common synonyms are given to facilitate reference. The distribution has as a rule been taken from the works quoted, while the notes on the life history and other details were obtained from our breeding records.

Among the leaf-eating insects many are not pests in the correct sense of the word, but they are nevertheless noted since they may develop in importance where derris is grown as a pure crop on a large scale. Control for leaf-eating insects will probably be limited to hand picking, partly owing to the fact that there are no facilities for spraying on many estates where derris is grown, but largely because spraying operations would not only be of doubtful value with this crop owing to the great difficulty of applying the spray efficiently among the creeping stems and matted foliage, but the cost of such operations would rarely be an economic proposition. In the case of the root feeders, however, control by fumigation or other methods will have to be undertaken.

1. LEAF FEEDERS.

HESPERIIDAE.

Parata alexis, F.

- Parata alexis*, F. Moore and Swinhoe, Lepid: India IX
p. 253. Synonym-*Hasora alexis* F.
- Distribution - Java, Borneo, China, Ceylon, India,
Burma, Andamans, Malay Peninsula.
- Food Plants - *Pongamia glabra* (India) derris
(Malaya.)
- Life History - Larva greenish purple with darker fascia
on dorsum, thinly clothed with whit-
ish hairs; head large, brown. Rolls
leaf and pupates inside; pupal period
about 8 days.
- Status - Minor pest.
- Control - Hardly necessary at present; rolled
leaves may be picked.

ARCTIIDAE.

Amsacta lactinea, Cram. ✓

- Amsacta lactinea*, Cram. Seitz, Macrolepid: of World, English
Edn. X p. 251.
- Estignene lactinea*, Cram. Fletcher, Some South Indian Insects
p. 368.
- Cretonotus lactineus*, Cram. Dammerman, Landbouwdierkunde
van Oost-Indië p. 130.
- Distribution - India, Ceylon, Burma, Sunda Islands,
Philippines, Java, China, Japan,
Malay Peninsula.
- Food Plants - Numerous. *Pennisetum typhoideum*,
coffee and others in India; soy bean,
lantana and others in Java; tea,
chilies and derris in Malaya.
- Life History - Eggs laid in mass on leaf or shoots;
larva black with long dark brown
hairs arising from tubercles on body.
and with red spots sub-dorsally,
Feeds openly on leaf; pupates in
ground; ceases feeding 2 to 3 days
before pupation, pupal period 14 days.
- Status - So far not serious in Malaya, except on
one occasion on chilies, but a serious
local pest of *Pennisetum typhoideum*
in India.

- Control - Hand picking and collection of egg masses sufficient at present.

GEOMETRIDAE.

Anisodes obrinaria, Guen.

Anisodes obrinaria, Guen. Hampson, Fauna of British India, Moths III p. 446.

Synonym—*Anisodes obliuaria*, Wlk.

- Distribution. - Khásis, Bombay, Nilgiris, Ceylon, Moulmein, Andamans, Borneo, Solomons, Malay Peninsula.
- Food Plants - Derris (Malaya).
- Life History - Larva feeds openly and pupates on leaf. Pupal period about 6 days.
- Status - Hardly a pest.
- Control - Not necessary.

PSYCHIDAE.

Mahasena sp.

An unknown species found doing minor damage. Other species of *Mahasena* are pests on coconut, arecanut and African oil palm in Malaya. Nothing is known at present about the species on derris.

LIMACODIDAE.

Belippa laleana, Moore.

Belippa laleana, Moore. Hampson, Fauna of British India, Moths I p. 399.

Dammerman, Landbouwdierkunde van Oost-Indië p. 112.

Synonym—*Cheromettia ferruginea*, Moore.

- Distribution - India, Ceylon, Rangoon, Bhamo, Java, Malay Peninsula.
- Food Plants - Tea (Ceylon), coconuts, coffee, banana and others in Java. Derris (Malaya).
- Life History - Larva stout, oval in shape, jelly-like; pale bluish green with yellow and black spots. Feeds openly, pupates in round cocoon.
- Status - Hardly a pest.
- Control - Unnecessary.

THYRIDIDAE.

Striglina scitaria, Wlk.

Striglina scitaria, Wlk. Hampson, Fauna of British India, Moths I p. 354.

- Distribution - Japan, Formosa, India, Ceylon, Burma, Andamans, Borneo, New Guinea, Solomons, Australia, Fiji, Malay Peninsula.
- Life History - Larva greenish yellow, first thoracic segment yellow, head brown; dark brown spots on 2nd. thoracic to anal segments; a few short hairs on body. Pupates in folded leaf; pupal period 8 days.
- Food Plants - Dadap, *Bauhinia purpurea*, and derris in Malaya.
- Status - Minor pest.
- Control - Hand picking if necessary.

PYRALIDAE.

Lamprosema diemenalis, Guen.

Nacoleia diemenalis, Guen. Hampson, Fauna of British India, Moths IV p. 316.

- Distribution - S. Africa, Formosa, Ceylon, India, Burma, Andamans, Sumatra, Java, Celebes, Fiji, Malay Peninsula.
- Food Plants - In Malaya—Centrosema, soy bean, indigo, ground-nut; *Tephrosia candida*, *Sesbania aculeata*, *Clitoria cajanifolia*, *Calopogonium mucunoides*, *olichos* spp., derris.
- Life history - Eggs on leaf; larva smooth, greenish grey above, green below, head ochreous. Pupates in folded leaves; pupal period 6 to 8 days. Larva parasitised by *Chelonus* sp., another Braconid, and an Ichneumonid.
- Status - Fairly serious, especially when parasites are scarce.
- Control - Hand picking usually sufficient, but spraying may have to be undertaken.

Maruca testulalis, Geyer.

- Maruca testulalis*, Geyer. Hampson, Fauna of British India, Moths IV p. 393
Fletcher, Some South Indian Insects, p. 440.
- Dammerman, Landbouwdierkunde van Oost-Indië, p. 189.
- Distribution - Throughout Neotropical, Ethiopian, Oriental and Australian regions.
- Food Plants - Tobacco (Java) *Tephrosia candida* and *Cajanus indicus* (Ceylon) beans (Porto Rico) pulses (India) In Malaya —beans, *Sesbania aculeata*, *Mucuna pruriens*, derris.
- Life History - Larva pale greenish yellow with brown warts from which arise short hairs. Usually known as the 'bean pod borer' from its habit of boring into the pods, but in Malaya feeds on leaves as well, webbing them together. Pupa in silken case in folded leaves; pupal period 6 to 7 days.
- Status - Very minor pest.
- Control - Unnecessary.

Maruca amboinalis, Feld.

- Maruca amboinalis*, Feld. Hampson, Fauna of British India, Moths IV p. 394.
- Distribution - Khâsis, Nilgiris, Burma, Borneo, Amboina, Malay Peninsula.
- Food Plants - *Tephrosia candida* (India) *Pongamia glabra* and derris (Malaya.)
- Life History - Larva yellow with short single hairs arising from very small tubercles; head brown, large. Webs and folds leaves, pupating in silken cell; pupal period 7 to 8 days. Has not been observed eating the pods of the known food-plants.
- Status - The commonest leaf-eating pest found on derris and may do considerable damage.
- Control - Hand picking of larvae and pupae probably the most that can be done, but spraying may have to be resorted to.

EUCOSMIDAE.

Eucosma balanoptycha, Meyr.*Eucosma balanoptycha*, Meyr. Meyrick, Rec. Ind. Mus., V p. 218.

Distribution	- India, Malay Peninsula.
Food Plants	- <i>Pongamia glabra</i> (India) derris (Malaya.)
Life History	- Little known. Larva folds youngest leaves, pupating inside; pupal period about 6 days.
Status	- Hardly a pest.
Control	- Unnecessaay.

Eucosma defensa, Meyr.*Eucosma defensa*, Meyr. Meyrick, Exotic Microlepidoptera, II pt. 17 p. 517.

Distribution	- Fiji, Malay Peninsula.
Food Plants	- <i>Pongamia glabra</i> (Fiji) derris (Malaya).
Life History	- Little known. Larva feeds on leaves; pupal period about 10 days.
Status	- Hardly a pest.
Control	- Unnecessary.

2. ROOT FEEDERS.

Some evidence of damage by insects to the roots of derris had been noted on several occasions before any insects were actually found. The first sample which was found with the insects present, however, yielded no fewer than four which were apparently feeding on the root while one or two others were present whose status could not be defined. Two Bostrichids, a Scolytid and a Tenebrionid were certainly feeding and the larvae of, it is believed, all four were found. For the present they have simply been separated as.—

Bostrichid No. 2337.

,, No. 2338.

Tenebrionid No. 2336.

Scolytid No. 2341,

In order to confirm whether the infested roots were really *Derris* sp. or those of some other plant which had been mixed with the derris, a portion of the uneaten material was taken and an extract made in the usual way. This was then tested on some caterpillars

and proved to be toxic, as well as having the typical appearance and smell of derris extracts. A portion of the excreta from Bostrichid No. 2337, which was the dominant insect, was then taken and tested in the same way. The extract prepared from the excreta had no effect on other members of the same batch of caterpillars nor on the nymphs of *Dysdercus cingulatus*, F. which are particularly susceptible to derris. It was thus concluded that the tubatoxin and other substances contained in the root were almost, if not entirely, destroyed by the digestive fluids of this insect.

The life history of these insects is under investigation, but Bostrichid No. 2337 is certainly the most important of the four mentioned. One is apparently parasitised by a (?) Braconid, a cocoon having been found in one of the galleries attached to the remains of a larval skin. In the samples obtained it is estimated that 50% of the roots had been destroyed, and with continued infestation there appears to be no reason why the whole of the crop should not be lost.

Infestation by these insects will have to be watched for where derris is stored, and strict sanitation will be required. In addition to this fumigation will probably have to be resorted to. It will not be possible to employ heat as a control measure owing to the chemical changes brought about in the toxic principles by its agency. Since writing the above several additional cases of infestation of stored derris roots have been reported. In each case Bostrychid No. 2337 was the dominant if not the only insect present, and the damage done was of a very serious nature. In one case practically the whole of the crop from an estate was destroyed in the store. and since the infestation is capable of increasing during transit, it behoves growers to examine their roots most carefully during storage and before shipment.

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OBSERVATIONS ON COVER CROPS AT CASTLETON ESTATE.

By B. BUNTING AND T. D. MARSH.

THE following notes are the result of observations made on a number of cover crops now being grown at Castleton Estate, Teluk Anson.

The plots are only small, being about 1/20 acre in extent, and were primarily laid down with the undermentioned objects:—

- (i) To ascertain the suitability of various cover plants for growing on the flat alluvial clays of the Lower Perak District.
- (ii) Demonstration purposes.

With the exception of *Mikania scandens* and *Vigna oligosperma*, which were propagated from cuttings, the whole of the cover plants were raised from seed.

The seed was sown on the various plots during the last week in October, 1924, in well-changkolled and clean land so that the observations are made over a period of approximately one year.

There was one coconut palm, about 15 to 20 feet high to the base of the leaves, growing in the centre of each plot and the soil conditions were very similar throughout the whole of the plots.

Canavalia ensiformis.—Seeds of this cover plant were dibbled in changkolled land 3 ft. apart each way. The plants came away vigorously, producing a good growth of green material and would be useful as a quick-growing green manure for changkolling into the soil for intensive forms of cultivation. It grows about 3 feet high and covers the ground fairly well. The cover produced a fair crop of seed after which it died out. After the plants were fully grown and had flowered, about 10 per cent of them died as a result of a fungus disease which attacked the roots and main stem. The cover lasted about 6 months only and the plant did not re-seed itself, probably because the surface of the ground was too hard.

A second lot of seed was dibbled in between the former rows of plants in April, 1925, without further changkolling. These plants have made very poor growth and are practically a failure.

Calopogonium mucunoides.—Seed was sown in rows 3 ft. apart each way in October, 1924. After a period of about 3 months, the plants had completely covered the ground, whilst after 5 months they formed a dense cover 1 foot deep and at that time were seeding to a limited extent. It is particularly suited to this class of soil and makes an excellent cover. In the original 1/20 acre plot it has not grown much under the shade of the coconut palm and even the few plants that grew appear to be dying out, which may be due to the fact that the soil is

very poor near the palms. In other areas, however, under small coconuts about 1½ years old it flourishes and has to be continually taken away from the palms to prevent it climbing up the trunk. During the whole period this cover has shown vigorous growth, but there are a few patches where all the leaves appear to be scorched and the plants have died out.

Cassia hirsuta. The germination of the seed of this cover was poor but the few plants that grew were fairly good. Seed was dibbled in 2 ft. x 2 ft. apart. The plants are now almost 5 to 7 feet high, but the growth is fairly open in character and the cover throws little shade, consequently has little effect in checking weeds. In the re-sown parts of the plot the plants have not done so well, probably because the land was not rechangkolled and the rain had beaten the soil down somewhat before re-sowing. This cover is not altogether a complete success.

Cassia mimosoides.—Seed of this cover was sown about 2 ft. apart each way. One to three seeds were dibbled in each hole in well-changkolled land, but after germination only one plant was left per hole. The growth was very slow at first, the plants taking several months to cover the ground and provide sufficient shade to check the growth of weeds. When the plants attained a height of about 2½ to 3 feet they completely covered the ground and provided such dense shade that no weeds grew. The plants are still growing vigorously and have now attained a height of 10 to 12 feet. This cover is almost impenetrable, but has become somewhat woody.

Cassia occidentalis.—Seed was dibbled in 2 ft. x 2 ft. apart. The plants grew into a straggling weedy cover about 4 feet high with no vigour, consequently giving no shade. This cover plant flowered about the middle of December, 1924, and is undoubtedly useless on this type of land. Half of the plot was pruned to about 1 foot off the ground during March, but the cover never recovered from this pruning and gradually died out over the pruned area.

Centrosema Plumieri.—The seed of this cover was dibbled in 3 ft. x 3 ft. apart in what is probably one of the worst areas of these demonstration plots, consisting of a wet plastic clay which is difficult to drain. On part of the plot, which was fairly dry, the cover, after a struggle, has become fairly well established and is looking healthy. On the rest of the area it has scarcely grown at all. It might be stated here that this plot adjoins on one side *Vigna oligosperma* and on the other side *C. pubescens*, but the latter plot was the best. All the three plots have soil of a similar character.

Centrosema pubescens.—Seeds were dibbled in 3ft. x 3ft. apart. This cover was planted on a wet patch of ground and for this reason was not altogether a success. It has been re-sown over part of the plot three times and at first was a very straggling cover almost choked by weeds in spite of the fact that since sowing it was weeded several times. During the dry weather it improved wonderfully and has now produced a fairly good cover. It is far superior to *C. Plumieri* but, like the latter, it will not thrive under wet conditions.

This cover dies out in patches similar to *C. Plumieri* and *Calopogonium mucunoides*. The plant takes a long time to become established and the soil conditions are probably unsuitable for its successful growth.

Clitoria cajanifolia.—Seed of this cover was sown 2 ft. x 2 ft. apart, but germinated badly and part of the area had to be re-sown. Although slow in getting established the plant is now showing a fair growth, but it is not exactly suitable as a cover crop. It is somewhat woody and hardly provides sufficient shade to keep down weeds. As the plant has a habit of throwing out numerous branches on the ground level it would make an excellent cover for planting in close rows on hill sides in place of Citronella and Lemon grass, to check erosion of the top soil.

Crotalaria incana.—Seed was sown 2 ft. x 2 ft. apart. This cover has a very weak growth and the plants are stunted. The plants commenced flowering at the end of December when only about one foot high and have been seeding freely ever since. This cover is useless on this type of land and has not yet covered the surface. The best plants are 3 to 4 feet high, but they have a stunted leaf growth and generally lack vigour.

Crotalaria striata.—This cover has been vigorous from the time of sowing. The seed was dibbled in 2 ft. x 2 ft. apart and the plants commenced flowering about the middle of December. A few weeks after germination this cover gave sufficient shade to stop the growth of all weeds. The plants are now 10 feet high and, judging from the large bulk of green material produced, would make an excellent green manure. Half of the plot was cut down to 1½ feet from the ground on two occasions and this is now 6 feet high again. The uncut part of the plot has been seeding freely for the past four months.

Crotalaria usaramoensis.—Seed of this cover was dibbled in 2 ft. x 2 ft. apart. This plant has produced the heaviest and quickest growth of all the covers under observation, taking possession of the ground very quickly and choking out all weed growth. Flowering commenced at the beginning of December and the plants, which have been seeding freely for the past 5 months, have now attained a height of 10 to 12 feet. Half of the plot was cut down on two occasions to 1½ feet from the ground and this has now grown again to a height of about 6 feet, producing a large quantity of green material. A few plants in the uncut part of the plot have recently died, probably as a result of seeding too freely. The objection to this cover is that it is comparatively short-lived.

This crop from all appearances, has a high value as a green manure and may be kept growing for a longer period by constant pruning, thus preventing it seeding. The heavy clay type of soil evidently suits this cover.

Desmodium tortuosum.—The plants produced were weedy and spindly, about 2 to 3 feet high, and were a complete failure. The

seed was sown 2 ft. x 2 ft. apart and the plants flowered in the middle of December, producing ripe seed at the end of January. The original plants are practically all dead, but the new seedlings are now growing. It has been necessary to weed the plot monthly. This plant although practically of no value as a cover might prove useful as a fodder crop if sown thicker.

Indigofera hirsuta.—Seed of this cover was dibbled in 2 ft. x 2 ft. apart. The plant has made a very good growth of green material and appears to do equally well under shade of a large coconut palm as out in the open.

The ground was completely covered about 4 months after sowing. This plant retains a vivid green colour and has bright pink flowers with clusters of very hairy pods at the ends of the flowering stalks, both of which have a hanging or drooping habit. The whole plant is covered with brown hairs. It makes a very attractive cover having a semi-erect growth, but spreads over the ground without becoming a dense mass of dead brown stalks as in the case of *Mimosa invisa*. The plant grows to a height of about 2 feet and has almost taken possession of the ground, but there is a little grass growing on the plot. Care and attention are required to get it established, and further trials on this type of land, appear to be warranted.

Leucaena glauca.—The germination of the seed was very bad and only about half a dozen plants were established. The growth was not at all promising and although these few plants have 1/20 of an acre of ground they have not thrown out any branches. They mostly consist of single, nearly upright, stems about 3 to 5 feet high, bearing a few flowers and pods, consequently practically no shade is thrown and the cover would have to be sown very thickly to produce a stand of bushes sufficient to prevent the growth of weeds.

Mikania scandens.—A few cuttings were received from Serdang and were planted 3 ft. x 3 ft. apart. Only three or four of these cuttings survived the train journey and the ultimate transplanting, and they had to be watered to keep them alive. As soon as sufficient rain had fallen, the plants commenced to grow very vigorously and after about four months the whole plot was covered to a depth of 6 to 12 inches. All weed growth was checked and the expression "the mile a minute plant," which is frequently used in relation to this cover, aptly describes it. One cutting planted in the centre of four rubber or coconut trees would be sufficient to give a complete cover to this area in a short space of time. Shade does not appear to affect it, but conditions on these plots, as regards shade, hardly warrant an expression of opinion. This cover plant unfortunately is non-leguminous and therefore does not enrich the soil.

Mimosa invisa.—This cover is eminently suited to this type of soil. The seed was dibbled in 3 ft. x 3 ft. apart and in about three months the ground was so completely covered that all weed growth was checked. It has been necessary on several occasions to keep the cover from spreading to other plots by turning it back on the edges of the plot. This particular plot is now, and has been for the past 4 or 5 months, a solid mass of green material.

Sesbania aculeata.—This plant has given very poor results. The seed was dibbled in 2 ft. x 2 ft. apart and the plants grew to a height of about 8 feet. This cover throws no shade and the plants first flowered about January 15th. Half of the plot was pruned to 1½ feet from the ground and this operation practically killed off all the plants, whilst those on the unpruned portion of the plot are now dying out. The plots had to be weeded monthly, and this cover must be described as a failure.

Sesbania sericea.—The remarks made about *S. aculeata* apply to this cover, but it does not live so long. Seeds were sown 2 ft. apart each way. The young plants came away at first slightly better than *S. aculeata* and flowered in the middle of December, but now they are all dead. This plant is of no use as a cover crop.

Tephrosia candida.—Seed of this cover was sown 3 ft. x 3 ft. apart and produced good vigorous plants, which have grown to a height of about 10 feet. The plant forms a thick cover suppressing practically all weeds. Half of the plot was cut back once to 1½ feet from the ground. This portion has grown almost as tall as the uncut area, is more dense in growth and has formed a better cover. This plant forms one of the most satisfactory cover crops, both from the point of view of shade and green manure.

Tephrosia Hookeriana var. *amoena*.—This plant is not so vigorous as *T. candida*, but if the seed is sown thicker than the latter, a good cover growing to a height of 3 to 4 feet will be obtained. It seeds profusely and makes a very satisfactory cover. The individual bushes are not so dense as *T. candida*, consequently unless the seed is sown more thickly the shade is not so heavy.

Tephrosia purpurea.—The seed of this cover was sown 2 ft. x 2 ft. apart and the plants have attained a height of about 2 feet. This is rather a delicate bushy cover. Although probably valuable as a green manure it is not dense enough to suppress weeds and for this reason the seed would have to be sown very thickly on the ground. The plant is now seeding heavily.

Tephrosia Vogelii.—This cover plant was tried but the seed failed to germinate. A fresh supply of seed was procured, but the growth of the plants is so small that further comments are unwarranted until the trial is more prolonged.

Vigna oligosperma syn. *Dolichos hosei*.—Owing to the difficulty of obtaining seed this plant was propagated from cuttings, which were planted 3 ft. apart each way. This well-known cover plant has been anything but satisfactory probably owing to soil conditions, having been planted on a wet heavy clay. It should, however, be stated that in this district the plant has been successfully established on alluvial clay land under the shade of old rubber.

SUMMARY.

Calopogonium mucunoides, *Cassia mimosoides*, *Centrosema pubescens*, *Crotalaria striata*, *C. usarmensis*, *Indigofera*

hirsuta, *Mikania scandens*, *Mimosa invisa*, *Tephrosia candida* and *T. Hookeriana* var. *amoena*. have given the best results from the point of view of producing a good cover and checking the growth of weeds.

Canavalia ensiformis, *Cassia mimosoides*, *Crotalaria striata*, *C. usaramoensis*, *Indigofera hirsuta*, *Tephrosia candida*, *T. Hookeriana* var. *amoena* and *T. purpurea* produced large quantities of green material and therefore are eminently suitable for use as a green manure, more particularly as they are all leguminous plants.

Mikania scandens and *Vigna oligosperma* were the only cover plants which gave any indication of being successfully established under shade on this type of soil.

Centrosema Plumieri, *Cassia hirsuta*, *C. occidentalis*, *Clitoria cajanifolia* and *Vigna oligosperma* showed very poor growth indeed, probably owing to the soil conditions being unsuitable, whilst *Crotalaria incana*, *Desmodium tortuosum*, *Leucaena glauca*, *Sesbania aculeata*, *S. sericea* and *Tephrosia Vogelii* proved a complete failure.

Canavalia ensiformis, *Crotalaria incana*, *C. striata*, *C. usaramoensis*, *Indigofera hirsuta*, *Sesbania aculeata* and *S. sericea* have the objection of being only short-lived and therefore the areas must be periodically replanted with fresh seed.

Although the plots are small and the trials only of very short duration the above results give some indication as to the comparative values of the different cover plants on this particular type of soil.

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NOTES ON THE CULTIVATION OF ANNATTO.

By B. BUNTING.

ANNATTO, *Bixa orellana*, is a large quick-growing shrub or small tree, native of tropical America.

The plant is cultivated on a small scale in India, Ceylon, the West Indies and other tropical countries for the dye afforded by its seeds. It also makes a good hedge, screen or windbreak.

CULTIVATION.

The tree is readily propagated from seed which is sown broadcast in slightly raised nursery beds about 5 feet wide. As soon as the seedlings appear they should be thinned out to about 6 inches apart. When the young plants are from 9 to 15 inches high they should be planted out in the field at distances of from 15 to 18 feet apart. The plant is very hardy indeed and requires no shade either in the nursery or when transplanted in the field.

The tree makes rapid growth in the open and under ordinary conditions will attain a height of 10 to 12 feet at the age of about two years, when it will begin producing fruit. It will continue to fruit for a number of years and the only attention it requires is systematic weeding and pruning of any dead branches.

There are apparently two varieties, one with a white flower with greenish capsules and the other with a pink flower and reddish capsules, the latter being the one usually cultivated. The flowers occur in terminal clusters while the fruits are ovoid, spiny, two-valved pods, containing from 30 to 50 seeds. The seeds are surrounded by a scarlet tissue from which the dye is obtained.

YIELD.

The fruits are collected when nearly ripe and as the shells dry they burst open. The seeds are separated from the pods and after being thoroughly dried in the sun they are screened and shipped without removing the scarlet covering containing the dye. In this condition they are packed in double gunny bags and marketed as Annatto "seed." Unfortunately the seed does not keep well and old stock is worth very little compared with fresh seed.

The yield is somewhat variable, but records from the Government Experimental Plantation, Serdang, show that the plant commences to fruit at about two years from the date of planting. The first year's crop gave an outturn of 5 cwt. of dry seed per acre and it is probable that this yield will be exceeded as the trees become older. Although the tree continues to produce fruit all the year round the

heaviest crops are obtained in the months of March and September, following the dry periods. The market price fluctuates considerably and it has been known to vary from 3d. per lb. up to as high as 1s. 6d. per lb. C. I. F. London. The present price is about 8d. per lb.

USES.

Annatto dye is used to a small extent in colouring lacquer, silk, calico and wool, but its principal use is as a colouring matter for various foodstuffs more particularly butter and cheese and there is a regular demand for the product for this purpose. The active principle of annatto is annatoin.

MARKETS.

Hitherto there has only been a limited demand for this product and the consumption for the United Kingdom was within the region of 100 tons per annum, whilst a corresponding quantity was imported into the United States. The whole business is a comparatively small one and the chief supplies come from Jamaica and Southern India, where the crop apparently grows wild.

If the food preservative proposals issued by the Ministry of Health are put into operation the use of gamboge and a number of coal-tar dyes giving a yellow colour, will be prohibited. This might mean that annatto seed, which at the present time is only used in very small quantities, will probably find a greater outlet, as this is one of the very few yellow dyes upon which a veto has not been placed. This would of course have the effect of stimulating interest in the Annatto market.

In connection with a suggestion that annatto might be cultivated in Malaya as a commercial crop, enquiries have been made by the Imperial Institute, at the request of the Malay States Information Agency, regarding the present position of the market for annatto and the chief industries in which the product is now used.

As a result of these enquiries one firm of merchants stated that the demand for annatto appears to be increasing but in their opinion it is doubtful whether the total present consumption would warrant the seed being produced as a cultivated crop. They considered that the demand would require to be quadrupled before such a course would be worth while.

If the producer were in a position to hold over his stock and to distribute it evenly over the year the business would be more profitable, but the lack of keeping quality of the product prevents this with the result that there is either too much on the market or none at all.

The wild crop from Southern India is rushed home as early as possible, usually about the end of February and early arrivals realise good prices. If a cultivated crop could be placed on the market earlier than the wild crop an increased price would be obtainable.

Further, a firm of manufacturers of cheese and butter colours, etc., who use annatto seed for the purpose, stated that the price of the best annatto still remains at a high figure ranging from 1s. to 1s. 3d. per lb, according to the quality and colour of the seed.

GENERAL.

The information obtained from leading firms of merchants, brokers and consumers suggests that no great increase in the demand for annatto is expected by the trade in consequence of the proposed new regulations of the Ministry of Health, but the possibility of marketing a cultivated crop earlier than the wild crop may be worth consideration.

A sample consignment of 10 cwts. of seed produced from a cultivated plot at the Government Experimental Plantation, Serdang, will shortly be forwarded home and, with the object of finding the most suitable market, it is hoped that it will be possible in future to make regular quarterly shipments of about this size.

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LONDON MARKET PRICE LIST 3rd QUARTER 1925.

Oil Seeds.

Castor (Bombay)	-	£22.15.0	per ton.
Copra (Ceylon)	-	£31.2.6	"
Do. (Straits)	-	£30.2.6	"
Cotton (Egyptian)	-	£12.12.6	"
Do. (Bombay)	-	£11.17.6	"
Groundnuts (Gambia, undecorticated)	-	£18.15.0	"
Do. (Chinese, decorticated)	-	not quoted.	"
Linseed (Bombay)	-	£21.15.0	"
Do. (Plate)	-	£18.17.6	"
Palm kernels. (West African)	-	£21.0.0	"

Oils.

Castor (Madras)	-	55/-	per cwt.
Do. (Pharmaceutical)	-	63/-	"
Do. (1st pressing)	-	58/-	"
Do. (2nd pressing)	-	56/-	"
Coconut (Cochin)	-	Nominal steady.	"
Do. (Ceylon)	-	45/3	per cwt.
Cotton seed (Egyptian, crude)	-	42/6	"
Do. (Bombay)	-	39/-	"
Groundnut (oriental, crude)	-	49/6	"
Do. (English)	-	49/-	"
Linseed (Calcutta)	-	48/-	"
Do. (Plate)	-	47/6	"
Palm (Lagos)	-	£39.10.0	per ton.
Do. (Sumatra)	-	£36.5.0	"
Palm kernel	-	41/6	per cwt.

Oil Cakes.

Coconut	-	£10.7 6	per ton.
Cotton (Egyptian seed)	-	£8.10.0 to £8.15.0	"
Cotton (Bombay seed)	-	£7.2.6 to £7.10 0	per ton.
Groundnut (decorticated)	-	£10.7.6 to £10.15.0	"
Linseed	-	£12.12.6 to £13.7.6	"
Palm kernel	-	£7.15.0	"

Essential Oils.

Cajeput	-	2/10	per b.
Camphor (Chinese, crude)	-	2/6	"
Do. (Japanese refined)	-	2/9	"
Camphor (oil)	-	51/-	per cwt.
Cinnamon (Ceylon leaf)	-	5/1 to 5/6	per lb.
Citronella (Ceylon)	-	2/1 to 2/2	"
Do. (Java)	-	3/9	"
Clove	-	6/9 to 7/-	"
Lemon grass (Cochin)	-	4/-	"

Essential Oils—contd.

Lime (West Indian, expressed)	-	not quoted.	
Do. (West Indian distilled)	-	9/3 to 9/6	per lb.
Patchonli (Penang)	-	14/6	"
Do. (Mysore)	-	No offers.	
Vetiver (Bourbon)	-	50/-	per lb. (nominal)

Spices.

Areca nut	-	57/6	per cwt.
Cinnamon (Ceylon)	-	1/8 to 1/11	per lb.
Cloves (Zanzibar)	-	11d. to 11½d.	"
Do. (Penang)	-	2/- to 2/6	"
Ginger (Japan)	-	90/-	per cwt.
Do. (Jamaica)	-	90/- to 120/-	"
Mace (mid. to good)	-	3/7 to 4/2	per lb.
Nutmegs (West Indian)	-		
100's	-	2/-	per lb.
80's	-	2/2	"
Pepper (Singapore black)	-	9d.	"
Do. (Singapore white)	-	1/1½	"

Drugs.

Ipecacuanha	-	8/6	"
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Natural Dyestuffs & Extracts.

Annatto (seed)	-	nominal.	
Gambia (block)	-	57/- to 60/-	per cwt.

Gums & Resins.

Guttapercha	-		
" Good to Fine	-	2/9 to 6/-	per lb.
" Low to Medium	-	9½d. to 1/7	"

Fibres.

Cotton (American Go to Mid)	-	12.29d. to 13.94d.	nom.
Do. (Egyptian Sakellaridis, G. F. to fine)	-	29.10d. to 37.85d.	"
Hemp (Manilla, "J" grade)	-	£45.10.0	per ton.
Do. (Mauritius)	-	£36 to £48.10.0	"
Do. (New Zealand)	-	£36 to £38	"
Do. (Sisal)	-	£28 to £48	"
Kapok (Indian)	-	10¾d. to 11d.	per lb.
Do. (Java)	-	1/2 to 1/2½	"

Foodstuffs.

Cocoa (Ceylon plantation)	-	85/- to 110/-	per cwt. (in bond)
Coffee East India	-		
Superior	-	160/- to 165/-	per cwt.
Medium	-	120/- to 140/-	"

Foodstuffs—contd.

Sugar (Java white)	-	15/6 per cwt. (excluding duty)
Tapioca (Penang, flake)	-	2½d. per lb.

Chemical.

Acetic acid (glacial)	-	£66	per ton.
Do. (80% comml.)	-	£38	"
Acetone	-	£73	"
Ammonia (.880)	-	£23	"
Calcium acetate (grey)	-	£15	"
Citric acid	-	1/3½d.	per lb.
Formalin (40% vol.)	-	£28.10.0 to £39	per ton.
Sodium bisulphite (60-62%)	-	£17	"
Sodium sulphite (anhydrous)	-	£27.10.0 to £28.10	"
Wood Kreosote (unrefined.)	-	2/9	per gallon.

The market for oil seeds and oils has generally been quiet, but prices have been well maintained, and will probably remain steady. Amongst oil cakes there has been a big demand for coconut cakes; linseed cakes has attracted good sales considering the high prices ruling: while palm kernel cake supplies are steady with supplies getting into a very small compass.

Spices remain at about the same level as last quarter.

Fibres of all kinds stand at lower prices, the hems in particular being much easier. Chemical call for no comment.

This Market Price List is based on quotations contained in the following periodical and lists

Lewis and Peat Ltd., Monthly Prices current (Baltic Dept).
2nd July 1925.

Lewis and Peat Ltd., Monthly Prices current West Indian
etc. 27th July 1925.

Fertilizer and Feeding Stuff Journal 12th August 1925,
26th August 1925.

Chemist and Druggist 15th July 1925, 22nd July 1925.

Perfumery and Essential Oil Record, August 1925.

British Trade Journal, August 1925.

Chemical Trade Journal, 28th August 1925.

Received for publication 30th September 1925.